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## Notes on the Jurassic of Tamazunchale (Sierra Madre Oriental, Mexico).

By ARNOLD HEIM (Zurich).

With 2 figures.

The Front Ranges of Sierra Madre Oriental from Victoria to Tamazunchale studied by the writer in 1925 are made entirely of folds of Cretaceous limestones, the two extremities excepted, where older rocks appear in the nucleus of the larger anticlines.

The oldest formations are found West of Victoria:

1. Gneiss with granate, granite, amphibolite, eclogite and phyllites. They are disconformably overlain by

2. Permo-Carboniferous, namely

a) a thick series of black schists and graywacke of carboniferous (*Peregrina* beds, Lower Carboniferous)<sup>1)</sup>, passing into

b) the well-known Red beds, which apparently represent the Permian. Thereupon, with the second disconformity, follow

3. the Cretaceous sediments: Novillo beds (auct.) 50 to 100 m, Gypsum beds 100—300 m (Lower Cretaceous ?), Tamaulipas limestone 1000 m (Middle Cretaceous), San Felipe beds 100—400 m and Mendez marls 1000 m (Upper Cretaceous).

The Novillo beds (limestone and ironstone) possibly excepted, which might belong to the uppermost Jurassic, no sediments of Triassic and Jurassic time are present.

In the South, along Rio Moctezuma (Rio S. Juan) above Tamazunchale, a total difference was found below the Cretaceous. The following series is exposed there beginning from below:

*Tamán beds auct. (Upper Jurassic).*

After having entered the mountains some 4 km above Tamazunchale, a hitherto unknown series was found by Dr. W. FEHR and the writer, made of well-bedded black, fine-grained and microcristalline limestone with black shale. For

<sup>1)</sup> Discovered by Mr. PARKER ROBERTSON of Tampico.

nearly 10 km the river has cut its way through mountains entirely made of this formation. The writer proposes the name after the village of Tamán situated in the center of its development and at highly fossiliferous localities (fig. 1).

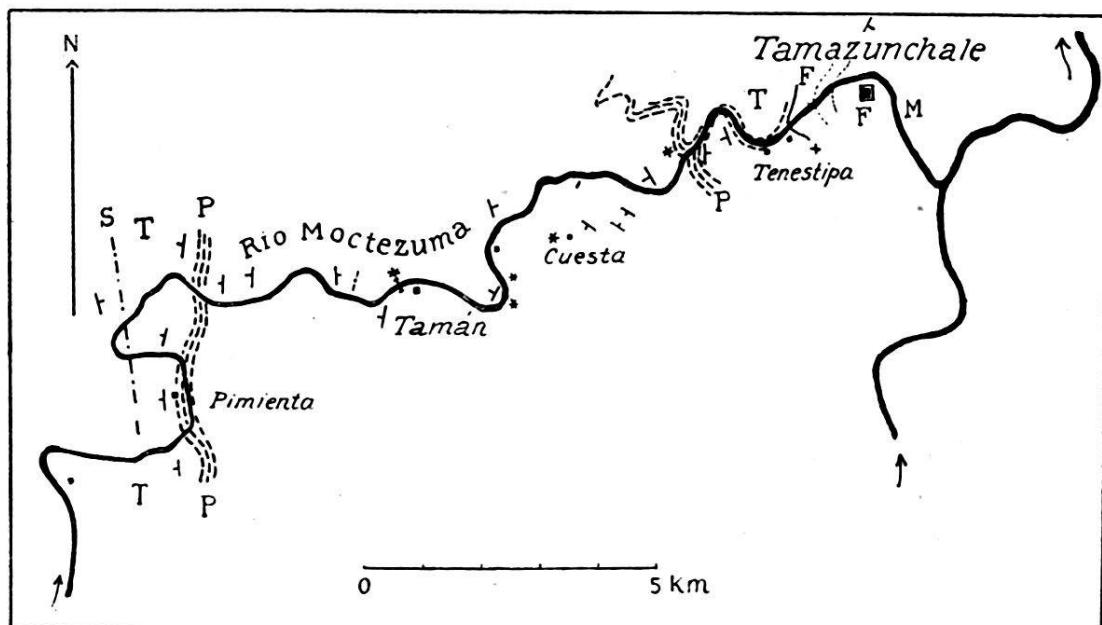


Fig. 1. Sketch-map of Rio Moctezuma above Tamazunchale by ARN. HEIM.

P = Pimienta beds.

+ Overthrust.

T = Tenestipa limestone.

S = Syncline.

F = San Felipe beds (Coniacian).

\* Fossils of Tamán beds (upp. jurassic).

M = Mendez marls (Senonian).

I am indebted to Dr. C. BURCKHARDT (Mixcoac, Mexico D. F.) for the determination of the fossils and the age of these beds.

The most abundant fossils are the Aulacomyellas, which, in certain layers, are accumulated by the thousands, one impression covering the other.

The principal fossiliferous localities encountered on a rapid excursion are:

1. Trail about 1½ km East of Tamán: *Haploceras Fialar* Ossel sp., *H. transatlanticum* Burckh., *Perisphinctes* sp., *Aptychus lamellosus* Park., *Aulacomyella Heimi* n. sp. = Upper Kimeridgian.

2. Trail West of La Cuesta: *Haploceras Fialar* Ossel sp., *Perisphinctes cyclodorsatus* Moesch in Fontannes, *Aspidoceras* juv. gr. *longispinum* Sow., *A. cfr. polysarcum* Font., *A. eligmoptychum* Font., *Aulacomyella lata* n. sp. = Upper Kimeridgian.

3. River bend East of Tamán: *Perisphinctes* sp. div. ind.

On the latter place, on black calcareous shale washed by the river, huge Ammonites up to 35 cm in diametre are seen in abundance at the surface. The intense cleavage of the rock however does not permit the collection. At the same place, numerous Brachiopods (*Rhynchonella* *cfr. arolica*) occur in another shaly layer. These beds, according to the structure, belong to the lower part of the Tamán beds (fig. 2).

The total thickness of the Tamán series is estimated to above 1000 metres.<sup>1)</sup>

#### *Pimienta beds.*

The Tamán Beds seem to pass upwards into a series of black, or black and white thin-bedded dense limestone rich of black chert layers. The name is proposed after the poor Indian huts of Pimienta situated above the trail on the steeply western dipping upper part of this subdivision (fig. 2).

The thickness of Pimienta beds was not measured, but may be estimated to about 100 or 200 metres at Pimienta, and less in the East at the village La Vega.

No fossils having been found, the age remains unknown, but is supposed as Portlandian.

#### *Tenestipa limestone.*

This name is given provisionally after the small Indian village of Tenestipa on the South side of Rio Moctezuma West of Tamazunchale.

It is a white dense limestone of about 100 to 200 m at Tenestipa, and several hundred metres in the region of Pimienta. The facies resembles that of Tamasopo Canyon limestone apart from the abundance of chert at Tenestipa. Its intimate relation with the Pimienta beds hardly allows

<sup>1)</sup> The so called " Tamán beds " belong mostly to the Upper Kimeridgian and represent the same horizon as the " couches à Haploceras du groupe Fialar ", described by C. BURCKHARDT from Mazapil and other localities of Central Mexico (Boletin Inst. geol. de Mexico No. 23, 1906). The Aulacomyellas are very frequent in mexican beds of this age and have been found by C. BURCKHARDT in Mazapil, by E. BOESE in the South of Monterrey, by ORDONNEZ and BURCKHARDT in Huayacocotla (Huasteca in the State of Veracruz), and by several Petroleumgeologists in the Isthmian region near Minatitlán (Chinameca etc.). In the latter locality Aulacomyellas, very nearly related to the type of the genus (*A. problematica* *Marthe Furlani* from the upper Jurassic " Lemes beds " in Dalmatia), have been collected in great number. These " Halobia like " shells have some times been mistaken for triassic fossils. (Additional Note by C. BURCKHARDT.)

a coordination with the Tamaulipas limestone of Victoria. The age may be Lower Cretaceous.

The relation with the middle cretaceous series (Tamaulipas-El Abra limestone) is not yet established.

At Xilitla, North of Tamazunchale, the typical El Abra limestone is overlain by Xilitla beds (= Lower Turonian), and underlain by dense limestone with chert resembling Tamaulipas and possibly identical with Tenestipa limestone.

**Structure.** The Tamán series forms the nucleus of a huge anticline of N to NW strike, with numerous secondary folds. The upper part of these folds continues towards NW into the cretaceous folds of Xilitla which are overlain by the overthrusted Tamasojo Canyon limestone of Sierra de Xilitla.

The autochthonous folds of Rio Moctezuma lean over towards East, and are thrust on its Eastern border upon an enormously crumpled front fold of cretaceous beds. East of Tamazunchale, the cretaceous sediments commence to plunge normally below the Tertiary of the coastal plain.

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14. Juni 1926.

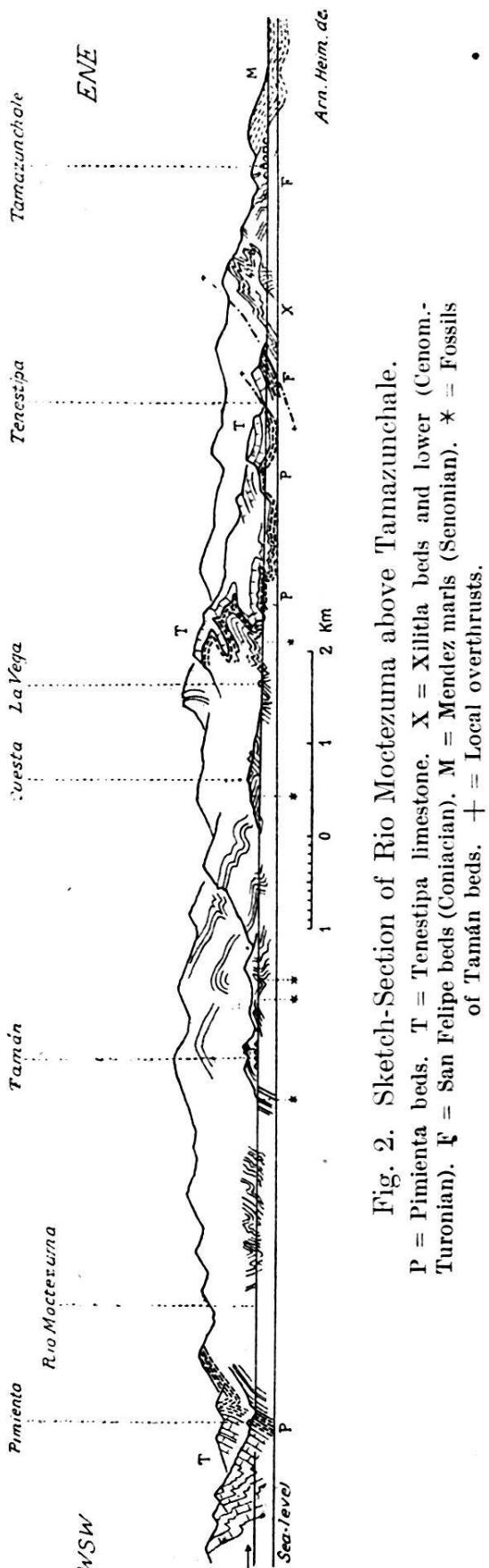


Fig. 2. Sketch-Section of Rio Moctezuma above Tamazunchale.  
 P = Pimienta beds. T = Tenestipa limestone. X = Xilitla beds and lower (Cenom-Turonian). F = San Felipe beds (Coniacian). M = Mendez marls (Semonian). \* = Fossils of Tamán beds. + = Local overthrusts.